

APPARATUS FOR REDUCING START-UP TIME BY AUXILIARY LIGHT SOURCE AND METHOD FOR THE SAME

BACKGROUND OF THE INVENTION

1. Field of the invention

5 The present invention relates to an apparatus for reducing warm-up time of a lamp and the method for the same, and particularly to a method for reducing start-up time of a scanner by auxiliary light source.

2. Description of the related art

10 In general operation of a scanner, a light source is needed to illuminate the documents to be scanned in order that the scanned image data of the document can be obtained by an optical image sensor module, such as a CCD module, in the scanner.

15 In light of the above, the scan quality of the scanner is based on the light source, and therefore scanner manufacturers have paid much attention to researches and developments in the light source of scanners.

 In addition, because scanners need the higher luminance, cold cathode fluorescent lamps (CCFLs) are adopted by mostly scanner manufacturers.

20 In consideration of the illumination quality, when the cold cathode fluorescent lamp is used as a light source, the scanner is designed to start a scan operation only when the cold cathode fluorescent lamp reaches a certain temperature, so the light emitted from the cold cathode fluorescent lamp is stable for scanning. Accordingly, upon turning on a scanner, it usually takes a warm-up time for a cold cathode fluorescent lamp to reach a sufficient temperature for stable illumination. Please refer to Fig. 1, which shows a
25 curve representing the warm-up time to luminance characteristic of a typical

cold cathode fluorescent lamp.

At the present time, the typical warm-up time of a cold cathode fluorescent lamp is approximately 90 seconds, which the users are not satisfied with, and hence scanner manufacturers tend to develop techniques for reducing the warm-up time to eliminate the dissatisfaction.

Therefore, a method for rapid warm-up of a cold cathode fluorescent lamp, such as the dual input voltage control scheme disclosed in US Patent No. 5,907,742, has been developed. That is, higher input voltage level (approximately 12 volts) is used during warm-up period to rapidly heat the cold cathode fluorescent lamp and hence to reach the operating temperature in early time, while lower input voltage level (approximately 8 volts) is used after the warm-up of the lamp. The above control scheme significantly reduces the warm-up time of the cold cathode fluorescent lamp to approximately 30 seconds. However, in order for fast warm-up of the lamp in the method, the cold cathode fluorescent lamp bears a higher current during warm-up period, which results in degradation of the lamp operational life.

Moreover, in order to create two different voltage levels respectively for warm-up period and for operational period, a pulse width modulator circuit which is a complicated circuit design, is provided to control the input voltage.

In addition, the frequency oscillator utilized in the above patent and built-in in the inverter, has an oscillation frequency drifting between 35~45 KHz under different voltages and temperatures. This will consequently cause unstable illumination and hence degrade the scan quality.

An alternative method for fast warm-up of a cold cathode fluorescent lamp is to provide a heating wire to the periphery of the lamp. In this case, the heating wire is wound around the outer surface of the cold cathode fluorescent

lamp, and, with the aid of heat generated by the heating wire around the lamp, the lamp temperature may be forced to increase more rapidly to thus achieve the fast warm-up. Although the fast warm-up of the lamp can be well-achieved by this method, an additional component, i.e., the heating wire, is required to be
5 provided to the periphery of the lamp and thus some additional steps must be added to the production process.

Furthermore, providing a heating wire adds up to increased costs, including the component cost and the power consumption cost. The most serious problem is that the heating wire wound around the outer surface of the
10 lamp partially blocks the light emitted from the lamp, which causes uneven illumination distribution of the cold cathode fluorescent lamp and in turn degrade the scan quality.

In view of the above, for rapid warm-up of cold cathode fluorescent lamps, those methods currently used in the art are very limited and still have unsolved
15 problems. Therefore, the inventor has employed technical ideas and developed an innovative invention different from the above-mentioned conventional methods.

SUMMARY OF THE INVENTION

It is the object of the invention to provide an apparatus for reducing
20 start-up time by using a light-emitting device with a fast start-up characteristic as an auxiliary light source.

To achieve the above object, according to the structure of the invention, an image sensor module for a scanner is provided with a cold cathode fluorescent lamp on one side and light-emitting diodes on the other side. The
25 light-emitting diodes, which have fast start-up characteristics, are turned on

simultaneously with the cold cathode fluorescent lamp, serving as an auxiliary light source to significantly reduce the start-up time of the scanner.

The method for reducing the start-up time of the scanner comprises the following steps:

5 (a) Igniting the cold cathode fluorescent lamp and the light-emitting device simultaneously so that the light-emitting device may serve as an auxiliary light source before the cold cathode fluorescent lamp reaches a stable status; and

(b) As the time goes, the current supplied to the light-emitting device is adjusted based on the luminance of the cold cathode fluorescent lamp so that
10 the integrated light source for illuminating the surface of the document may be kept stable.

The light source of said light-emitting device is formed by the light from light-emitting diodes.

The light source of said light-emitting device is formed by the light which
15 is emitted from a light-emitting diode and then transmitted through a light guide device.

In said step (b), adjusting the current supplied to the light-emitting device based on the luminance of the cold cathode fluorescent lamp is carried out by decreasing and controlling the current flowing through the light-emitting device
20 based on the increase in luminance of the cold cathode fluorescent lamp after ignition.

BRIEF DESCRIPTION OF THE DRAWINGS

Objects and advantages of the present invention will be fully understood from the detailed description to follow taken in conjunction with the
25 embodiments as illustrated in the accompanying drawings, wherein:

Fig. 1 shows a curve representing the warm-up time to luminance characteristic of a typical cold cathode fluorescent lamp;

Fig. 2 illustrates a top view of a preferred embodiment according to the present invention;

5 Fig. 3 shows a control flow chart of the present invention;

Fig. 4 shows another control flow chart of the present invention; and

Fig. 5 illustrates a top view of another preferred embodiment according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

10 Please refer to Fig. 2, which shows a top view of a preferred embodiment according to the present invention. An image sensor module 1 for a scanner is provided with a cold cathode fluorescent lamp 2 for illuminating a document reading position on one side and a plurality of light-emitting diodes 3 on the other side. The light-emitting diodes 3 have fast start-up characteristics, and
15 when turned on simultaneously with the cold cathode fluorescent lamp 2, may serve as an auxiliary light source for the cold cathode fluorescent lamp 2 so as to significantly reduce the start-up time of the scanner. The luminance of the integrated light source is detected by using a photo sensor connected to a control circuit (not shown). Thereby, through the operation of the program in
20 the control circuit, the current supplied to the light-emitting diodes 3 can be adjusted based on the detected luminance of the cold cathode fluorescent lamp so that the light source for illuminating a surface of a document may be kept stable.

Reference is made to Fig. 3, a control flow chart of a method for reducing
25 start-up time of a scanner according to the present invention, in relation to the

above-mentioned structure together with the program in the control circuit, is shown to comprise the following steps of:

(a) Igniting the cold cathode fluorescent lamp and the light-emitting diodes simultaneously so that the light-emitting diodes may serve as an auxiliary light source before the cold cathode fluorescent lamp reaches a stable status; and

(b) As the time goes, the current supplied to the light-emitting diodes is adjusted based on the luminance of the cold cathode fluorescent lamp so that the light source for illuminating the surface of the document may be kept stable, wherein adjusting the current supplied to the light-emitting diodes based on the luminance of the cold cathode fluorescent lamp is carried out by decreasing and controlling the current flowing through the light-emitting diodes based on the increase in luminance of the cold cathode fluorescent lamp after ignition.

Reference is made to Fig. 4, another control flow chart of a method for reducing start-up time of a scanner according to the present invention, also in relation to the above-mentioned structure together with the program in the control circuit, is shown to comprise the following steps of:

(a) Igniting the cold cathode fluorescent lamp and the light-emitting diodes simultaneously so that the light-emitting diodes may serve as an auxiliary light source before the cold cathode fluorescent lamp reaches a stable status;

(b) Detecting the luminance of the integrated light source by using a photo sensor;

(c) Determine the current amount required for the light-emitting diodes according to the detection result; and

(d) Varying the current flowing through the light-emitting diodes according to the required current amount so that the light source for illuminating the surface of the document may be kept stable.

The afore-mentioned plurality of light-emitting diodes can also be replaced by a light guide device and a light-emitting diode mounted on one side thereof, as shown in Fig. 5. In this case, the auxiliary light source for the cold cathode fluorescent lamp 2 is formed by the light, which is emitted from light-emitting diode 3' and then transmitted through the light guide device 4, to reduce the start-up time of the scanner. As the time goes, the current flowing through the light-emitting diode 3' is decreased and controlled based on the increase in luminance of the cold cathode fluorescent lamp 2 after ignition, so that the light source for illuminating the surface of the document may be kept stable.

In summary, according to the structure of the present invention operated in conjunction with the program, by using a light-emitting device having a fast start-up characteristic as an auxiliary light source, the start-up time of a scanner can be reduced.

While the present invention has been described with reference to the preferred embodiments thereof, it is to be understood that the invention should not be considered as limited thereby. Various modifications and changes could be conceived of by those skilled in the art without departing from the scope of the present invention, which is indicated by the appended claims.